REMARKS

Herein, the "Action" or "Office Action" refers to the Office Action dated 11/3/2004.

Applicant respectfully requests reconsideration and allowance of all of the claims of the application. Claims 1-4, 6-15 and 18-22 are presently pending. Claims amended herein are 1, 18, and 21. Claims withdrawn or cancelled herein are 5. New claims added herein are none.

Claim Objections

Claim 13

The Office objects to claim 13 because the status of this claim was identified as "original" in the listing of the claims in the previous response. It should have been identified as --currently amended--. Applicant acknowledges this informality and corrects it here by identifying claim 13 as "previously presented."

Claim 22

The Office objects to claim 22 because this claim was identified as claim "23" in the listing of the claims in the previous response. It should have been identified as claim --22--. Applicant acknowledges this informality and corrects it here by identifying this claim as claim "22."

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Substantive Claim Rejections

Claim Rejections under § 103

The Office rejects all of the pending claims (claims 1-15 and 18-22) under §103. For the reasons set forth below, the Office has not shown the prima *facie case* for obviousness (under §103) of the rejected claims. Accordingly, Applicant respectfully requests that the rejections be withdrawn and the case be passed along to issuance.

The Office's rejections are based upon the following reference:

- **Schweitz**: *Schweitz et al.*, US Patent No. 6,594,822;
- **Hsu**: *Ray Hsu*, US Patent No. 5,974,254.

Overview of the Application

The Application describes a technology for generating a minimum delta between at least two program binaries. The Application describes an implementation that is given a source program (S) in a binary format and a target program (T) in a binary form. It constructs control flow graphs (CFGs) of each. It matches common blocks of the S's CFGs and T's CFGs. The blocks are matched based upon their content and their local neighborhoods (e.g., *d*-neighborhoods).

In addition, blocks are matched using labels, which are based upon computed hash values. The matching is done in multiple passes where each pass improves the matching by relaxing the criteria for a match. In addition, the register renaming problems is solved so that blocks can be fairly compared.

The Application describes a technology that produces an intermediate output, which is the content of unmatched blocks. Such unmatched blocks are

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those found in T that are not found in S. It generates a set of edge edit operations for merging the unmatched blocks into S. The combination of the unmatched blocks and the edit operations is the delta. To patch S to produce a reconstructed copy of T, the delta is merged with S.

Cited References

In its obviousness-based rejections, the Office cites **Schweitz** as its primary reference and **Hsu** as its secondary reference.

Schweitz

Schweitz describes a technology for creating a software patch by comparing object files. Method and apparatus are provided that create a software patch using object files of two software sources. **Schweitz** creates software patches for software programs written any high-level language so long as the programs compile to a standard object file format, and required information can be recovered.

Functions of a compiled version of an existing software program are compared with an updated version that is compiled in a separate object file to discover a minimal set of changes, or "deltas" (for the patching process). The process for creating a patch includes decomposing the object file into cantles, examining fix-up information, creating reduced program dependency graphs, and comparing the graphs to determine the changes and create the patch. Because the software has already been compiled into object files, **Schweitz** is source-code

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independent and can be applied to code written in C/C++, Pascal or even to other specific proprietary languages.

Hsu

Hsu describes techniques related to detecting differences between two graphical programs. The graphical programs include objects, preferably arranged as a user interface panel, including controls and indicators, and a block diagram, including graphical code function blocks connected together as a data flow program. Directed graph data structures are created to represent the graphical programs, wherein the vertices of the graphs are the objects of the graphical programs and the edges of the graphs are data flow signals of the block diagram and/or hierarchical relationships of the user interface panel objects.

The objects of the two graphical programs are heuristically matched together using a scoring approach. The scores are stored in a match matrix and indicate a degree of similarity between an object in the first graphical program and an object in the second graphical program according to one or more criteria. The matching criteria include object type, object connectivity and object attributes. The match matrix is resolved to generate a 1:1 or 1:0 correspondence between the objects in the first and second graphical programs based on the match scores.

The matching information is used to determine differences in the two graphical programs. First, using the matching information and a compare engine, the objects are grouped into exact matching subgraphs and then into non-exact matching subgraphs. Non-exact matching subgraphs are matched and merged where possible using transitivity. Objects in the non-exact matching subgraphs are

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compared using the compare engine to detect additional differences. All detected differences are stored and displayed for the user. The differences may be displayed in various manners such as drawing a circle around the differences, highlighting the differences by color, and/or displaying a textual description of the differences.

Obviousness Rejections

Lack of *Prima Facie* Case of Obviousness (MPEP § 2142)

Applicant disagrees with the Office's obviousness rejections. Arguments presented herein point to various aspects of the record to demonstrate that all of the criteria set forth for making a *prima facie* case have not been met.

Based upon Schweitz and Hsu

The Office rejects claims 1-15 and 18-22 under USC § 103(a) as being unpatentable over **Schweitz** in view of **Hsu**. Applicant respectfully traverses the rejections of these claims. Applicant asks the Office to withdraw its rejection of these claims.

Claim 1

With the cited portions of the references provided in brackets, this amended claim recites [with emphasis added]:

- obtaining a first control flow graph (CFG) representation of the first binary and obtaining a second CFG representation of the second binary; **[Schweitz: Fig. 2, graphs 150 and 155]**

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- comparing the first and second CFG representations to identify blocks (nominally matched blocks) that match in the first and second CFG representations, thereby identifying blocks (nominally unmatched blocks) in the second CFG representation that do not match in the first CFG representation **[Schweitz: Col. 4, lines 28-29]**, the comparing being based upon content of blocks being compared and *augmented* local neighborhoods of blocks surrounding blocks being compared, wherein a local neighborhood of a particular block consists of blocks neighboring that block in a CFG representation, but less than all the blocks in that CFG representation, **[Hsu: from col. 4, lines 46 through col. 5, line 6; step 510 of Fig. 10; setup 128 of Fig. 8]** *and an augmented local neighborhood of that particular block consists that block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block, an augmented local neighborhood in a CFG representation consisting of less than all the blocks in that CFG representation;* **[Hsu: col. 13, 60-67]**
- determining edit-operations that merges the unmatched blocks into the first CFG representation so that first CFG representation is substantially identical to the second CFG representation; **[Schweitz: Col. 4, lines 29-32]**

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- producing a delta comprising the unmatched blocks and the edit-operations. **[Schweitz: Col. 4, lines 11-15]**

Applicant submits that the combination of **Schweitz** and **Hsu** does not disclose that the comparison is "based upon content of blocks being compared and *augmented* local neighborhoods of blocks surrounding blocks being compared, wherein a local neighborhood of a particular block consists of blocks neighboring that block in a CFG representation, but less than all the blocks in that CFG representation, *and an augmented local neighborhood of that particular block consists that block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block, an augmented local neighborhood in a CFG representation consisting of less than all the blocks in that CFG representation.*"

In its rejection of similar language that was previously found in claim 5, the Office cites **Hsu**, col. 13, lines 60-67, as follows:

> Next, diff scores remaining conflicts, i.e., objects which match according to type but which still have conflicts after resolving the matrix according to step 126, by examining immediately neighboring objects of the graph, in step 128. That is, the match score is updated by inspecting each terminal of the objects for matching upstream objects, matching downstream objects, and matching non-connections, i.e., terminals with no signals connected.

Applicant submits that **Hsu** does not appear to disclose a concept of an "augmented local neighborhood." More importantly, **Hsu** does not appear to disclose expanding the operational neighborhood to include a "block's local

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neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block."

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of this claim. Accordingly, Applicant asks that the Office withdraw its rejection of this claim.

Claims 2-4, 6, and 7

These claims ultimately depend upon independent claim 1. As discussed above, claim 1 is allowable.

In addition to its own merits, each of these dependent claims is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of each of these dependent claims because its base claim is allowable.

Claim 8

With the cited portions the references provided in brackets, this claim recites:

- matching blocks between the first and second CFG representations based upon the content of the blocks; **[Schweitz: Fig. 3C]**
- detecting outliers, wherein outliers are blocks in the first CFG representation that do not match any block in the second CFG representation during the matching step; **[Schweitz: col. 4, lines 29-32]**

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- computing a neighborhood of each block in the first and second CFG representations by performing a breadth first traversal; **[Hsu: col. 4, line 46 to col. 5, line 6; col. 14, lines 65-67, and col. 13, lines 60-63]**
- removing the outliers from each neighborhood. **[Schweitz: col. 1, lines 25-28 and col. 4, lines 29-32;** Office rephrases this element of the claim to read, "removing outliers by means of a patch."]

The Office admits that **Schweitz** does not disclose "computing a neighborhood of each block in the first and second CFG representations by performing a breadth first traversal," but indicates that **Hsu** does.

To support its assertion, the Office cites the following sections of **Hsu**:

> The method comprises first creating data structures to represent the first and second graphical programs. Preferably, the data structures include a directed graph for each of the block diagrams and user interface panels of each of the graphical programs. The vertices of the graphs correspond to the objects of the block diagram or user interface panel. The edges of the block diagram graph correspond to the data flow paths. The edges of the user interface panel graph indicate the hierarchical relationships of the user interface panel objects, such as parent/child relationships in data aggregation clusters.
>
> The method further comprises a step of matching the first plurality of objects of the first graphical program with the second plurality of objects of the second graphical program. The method attempts to match objects of the graphical programs to determine similarities between the two programs, and hence to aid in finding differences between them. Preferably, the matching is performed according to a matching heuristic which calculates scores indicating a degree of similarity between an object in the first graphical program and an object in the second graphical program according to one or more criteria. These scores, or matching information, are stored in a match matrix data structure. The rows of the match matrix correspond to the objects of the first graphical program and the columns of the match matrix correspond to the objects of the second graphical program. The matching is performed for both the block diagram graphs and the user interface panel graphs. [col. 4, line 46 to col. 5, line 6]

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...

> Diff simultaneously traverses both graphs representing the block diagrams to produce the list of exact matching subgraphs. **[col. 14, lines 65-67]**

...

> Next, diff scores remaining conflicts, i.e., objects which match according to type but which still have conflicts after resolving the matrix according to step 126, by examining immediately neighboring objects of the graph, in step 128. **[col. 13, lines 60-63]**

Applicant submits that **Hsu** does not disclose "performing a *breadth first* traversal" as recited in this claim. While **Hsu** is completely silent on how its graphs are traversed, this claim language is very specific about the type of traversal. It is a "breadth first traversal."

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of this claim. Accordingly, Applicant asks that the Office withdraw its rejection of this claim.

Claims 9-10

These claims ultimately depend upon independent claim 8. As discussed above, claim 8 is allowable.

In addition to its own merits, each of these dependent claims is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of each of these dependent claims because its base claim is allowable.

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Furthermore, Applicant submits that the combination of **Schweitz** and **Hsu** does not disclose "computing labels for each block...based upon content of a block," as recited in claim 9.

Further still, because **Schweitz** does not disclose neighborhoods (thus it does not operate on neighborhoods of blocks), Applicant submits that **Schweitz** cannot disclose [with emphasis added] "...forming a 'd-label' for each block in a neighborhood *based upon labels of the blocks within the neighborhood.*"

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of these claims. Accordingly, Applicant asks that the Office withdraw its rejection of these claims.

Claim 11

With the cited portions the references provided in brackets, this claim recites:

- computing a procedure-match-criterion for each procedure in the second CFG representation, where the procedure-match-criterion for a procedure in the second CFG representation represents the number of matching blocks between that procedure and a specified procedure in the first CFG representation; **[Schweitz: col. 8, lines 47-67 and col. 9, lines 1-19]**
- matching procedures in the second CFG representation with the specified procedure in the first CFG representation based

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upon the procedure-match-criteria for the procedures in the second CFG representation. **[Schweitz: col. 10, lines 30-43]**

The Office admits that **Schweitz** does not disclose "computing a procedure-match-criterion for each procedure in the second CFG representation, where the procedure-match-criterion for a procedure in the second CFG representation represents the number of matching blocks between that procedure and a specified procedure in the first CFG representation," but indicates that **Hsu** does.

To support its assertion, the Office cites the following sections of **Hsu**:

> **[col. 4, line 46 to col. 5, line 6 quoted herein on page 20]**
>
> ...
>
> Preferably, the matching is performed by calculating a weighted score which indicates a degree of matching or similarity between an object in the first graphical program and an object in the second graphical program according to the one or more criteria to produce matching information. **[col. 9, lines 32-36]**

Applicant submits that **Hsu** does not disclose a "procedure-match-criterion [that] represents the number of matching blocks between [two procedures being compared]" as recited in this claim.

At col. 12, lines 55-58, **Hsu** lists several criteria that it uses in matching objects. That list includes "object type and associated conflict in object type, connectivity, neighboring objects, object attributes, position and size." Applicant submits that **Hsu** does not disclose (in this list or elsewhere) the use of a criterion

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based upon the number of matching blocks between [two procedures being compared].

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of this claim. Accordingly, Applicant asks that the Office withdraw its rejection of this claim.

Claim 12

This claim ultimately depends upon independent claim 11. As discussed above, claim 11 is allowable.

In addition to its own merits, this dependent claim is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of this dependent claim because its base claim is allowable.

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Claim 13

With the cited portions the references provided in brackets, this claim recites:

- matching blocks between the first and second CFG representations based upon the content of the blocks; **[Schweitz: Fig. 3C]**
- computing successively smaller neighborhoods of each block in the first and second CFG representations via breadth first traversals; **[Hsu: col. 4, line 46 to col. 5, line 6; col. 14, lines 65-67, and col. 13, lines 60-63]**
- for each neighborhood computed in the computing step, forming a "d-label" for each block in a neighborhood based upon the labels labels of the blocks within the neighborhood; **[Schweitz: col. 9, lines 1-3]**
- attempting to match blocks between first and second CFG representations by comparing the d-labels of the blocks. **[Schweitz: col. 9, lines 1-3]**

The Office admits that **Schweitz** does not disclose "computing successively smaller neighborhoods of each block in the first and second CFG representations via breadth first traversals," but indicates that **Hsu** does.

To support its assertion, the Office cites **Hsu**: col. 4, line 46 to col. 5, line 6; col. 14, lines 65-67, and col. 13, lines 60-63. These portions of **Hsu** are quoted above on pages 20-21.

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In response to the rejection of claim 8, Applicant explains herein that **Hsu** does not disclose breadth first traversals.

Furthermore, **Hsu** also does not disclose computations of "computing successively smaller neighborhoods of each block [in a CFG representation]." Applicant submits that the Office has not identified, with particularity, any portion of **Schweitz** or **Hsu** that discloses a computation of successively smaller neighborhoods.

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of this claim. Accordingly, Applicant asks that the Office withdraw its rejection of this claim.

Claims 14-15

These claims ultimately depend upon independent claim 13. As discussed above, claim 13 is allowable.

In addition to its own merits, each of these dependent claims is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of each of these dependent claims because its base claim is allowable.

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Claim 18

With the cited portions the references provided in brackets, this claim recites:

- obtaining a first control flow graph (CFG) representation of the first binary and obtaining a second CFG representation of the second binary; **[Schweitz: Fig. 2, item 150 and 155]**
- comparing the first and second CFG representations to identify blocks (nominally matched blocks) that match in the first and second CFG representations, thereby identifying blocks (nominally unmatched blocks) in the second CFG representation that do not match in the first CFG representation **[Schweitz: Col. 4, lines 28-29]**, the comparing being based upon content of blocks being compared and *augmented* local neighborhoods of blocks surrounding blocks being compared, wherein a local neighborhood of a particular block consists of blocks neighboring that block in a CFG representation, but less than all the blocks in that CFG representation, **[Hsu: from col. 4, lines 46 through col. 5, line 6; step 510 of Fig. 10; setup 128 of Fig. 8]** *and an augmented local neighborhood of that particular block consists that block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block, an augmented local neighborhood in a CFG representation consisting of less than*

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all the blocks in that CFG representation; **[Hsu: col. 13, 60-67]**

- determining edit-operations that merges the unmatched blocks into the first CFG representation so that first CFG representation is substantially identical to the second CFG representation; **[Schweitz: Col. 4, lines 29-32]**
- producing a delta comprising the unmatched blocks and the edit-operations. **[Schweitz: Col. 4, lines 11-15]**

Applicant submits that the combination of **Schweitz** and **Hsu** does not disclose that the comparison is "based upon content of blocks being compared and *augmented* local neighborhoods of blocks surrounding blocks being compared, wherein a local neighborhood of a particular block consists of blocks neighboring that block in a CFG representation, but less than all the blocks in that CFG representation, *and an augmented local neighborhood of that particular block consists that block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block, an augmented local neighborhood in a CFG representation consisting of less than all the blocks in that CFG representation.*"

In its rejection of similar language that was previously found in claim 5, the Office cites **Hsu**, col. 13, lines 60-67, which is quoted on page 18.

Applicant submits that **Hsu** does not appear to disclose a concept of an "augmented local neighborhood." More importantly, **Hsu** does not appear to disclose expanding the operational neighborhood to include a "block's local

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neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block."

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of this claim. Accordingly, Applicant asks that the Office withdraw its rejection of this claim.

Claims 19-20

These claims ultimately depend upon independent claim 18. As discussed above, claim 18 is allowable.

In addition to its own merits, each of these dependent claims is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of each of these dependent claims because its base claim is allowable.

Claim 21

With the cited portions the references provided in brackets, this claim recites:

- a comparator that is configured to compare a first control flow graph (CFG) representation of a first program binary and a second CFG representation of the second program binary for identifying blocks (nominally matched blocks) that match in the first and second CFG representations, thereby identifying blocks (nominally unmatched blocks) in the second CFG representation that do not match in the first CFG

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representation **[Schweitz: Col. 4, lines 28-29]**, the comparing being based upon content of blocks being compared and *augmented* local neighborhoods of blocks surrounding blocks being compared, wherein a local neighborhood of a particular block consists of blocks neighboring that block in a CFG representation, but less than all the blocks in that CFG representation, **[Hsu: from col. 4, lines 46 through col. 5, line 6; step 510 of Fig. 10; setup 128 of Fig. 8]** *and an augmented local neighborhood of that particular block consists that block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block, an augmented local neighborhood in a CFG representation consisting of less than all the blocks in that CFG representation;* **[Hsu: col. 13, 60-67]**

- an edit-op determiner configured to determine the edit-operations that merges the unmatched blocks into the first CFG representation so that first CFG representation is substantially identical to the second CFG representation; **[Schweitz: Col. 4, lines 29-32]**
- an output sub-system that is configured to produce a delta comprising the unmatched blocks and the edit-operations. **[Schweitz: Col. 4, lines 11-15]**

Applicant submits that the combination of **Schweitz** and **Hsu** does not disclose that the comparison is "based upon content of blocks being compared and

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augmented local neighborhoods of blocks surrounding blocks being compared, wherein a local neighborhood of a particular block consists of blocks neighboring that block in a CFG representation, but less than all the blocks in that CFG representation, *and an augmented local neighborhood of that particular block consists that block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block, an augmented local neighborhood in a CFG representation consisting of less than all the blocks in that CFG representation.*"

In its rejection of similar language that was previously found in claim 5, the Office cites **Hsu**, col. 13, lines 60-67, which is quoted on page 18.

Applicant submits that **Hsu** does not appear to disclose a concept of an "augmented local neighborhood." More importantly, **Hsu** does not appear to disclose expanding the operational neighborhood to include a "block's local neighborhood plus a random sampling of blocks from a substantially larger neighborhood of blocks surrounding that block."

Applicant respectfully submits that the combination of the relevant teachings of **Schweitz** and **Hsu** does not disclose all of the elements of this claim. Accordingly, Applicant asks that the Office withdraw its rejection of this claim.

Claim 22

This claim ultimately depends upon independent claim 21. As discussed above, claim 21 is allowable.

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In addition to its own merits, this dependent claim is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of this dependent claim because its base claim is allowable

Dependent Claims

In addition to its own merits, each dependent claim is allowable for the same reasons that its base claim is allowable. Applicant submits that the Office withdraw the rejection of each dependent claim where its base claim is allowable.

Conclusion

All pending claims are in condition for allowance. Applicant respectfully requests reconsideration and prompt issuance of the application. If any issues remain that prevent issuance of this application, the Office is urged to contact the undersigned attorney before issuing a subsequent Action.

Respectfully Submitted,

Dated: 1-12-05 By: _____

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